

T01D07 - Limiting Reactants and Percent Yield

Pregame: A compound is 64.9% C, 13.5% H,
and 21.6% O. Its molar mass is 148 g/mol.
What is the molecular formula?

Take a look at Nomenclature Quizzes

Check Reaction HW



UNITS!!!!

- Density = _____ = ex. $D_{\text{H}_2\text{O}} = 1.00 \text{ g/mL}$
- Molar Mass = _____ = ex. $\text{MM}_{\text{H}_2\text{O}} = 18.02 \text{ g/mol}$
- Molar Volume = _____ = ex. $\text{MV}_{\underline{\text{G}}} = 22.4 \text{ L/mol}$
 - Can only be used for gases at STP (Standard Temperature and Pressure) or relating moles of gases in the same conditions!
- Avogadro's = _____ = ex. $6.022 \times 10^{23} \text{ mc/mol}$
- Molarity = _____ = ex. $6\text{M}_{\text{NaCl}} = 6 \text{ mol/L}$



Yield in Reactions

- Prediction vs. Results
- Theoretical Yield
 - The theoretical yield of a reaction is the amount of product that would be formed if the reaction went to completion. This can be calculated based on the limiting reactant.
- Experimental Yield
 - The amount of product obtained in a chemical reaction, also known as the Actual yield
- Percent Yield
 - The actual yield of a product as a percentage of the theoretical yield

$$\frac{\text{Experimental Yield}}{\text{Theoretical Yield}} \times 100 =$$

Example Percent Yield:

- If you calculated that you should get 3.5 grams of product but you run the experiment and only get 3.2 grams, what is your percent yield?
 - Theoretical Yield = 3.5 grams
 - Experimental Yield = 3.2 grams
 - Percent Yield = $3.2 / 3.5 \times 100 = 91\%$



Practice Percent Yield

- If you calculated that you should be able to produce 15.5 grams of NaCl from a reaction of sodium and chloride and you only get 12.7 grams in the lab, what is your percent yield?



Limiting Reagents

- With two reactants (A and B) in a chemical equation, three situations can occur:
 - Stoichiometrically equal amounts of A and B (ratio is met)
 - More A than B (A is in excess, B is limiting)
 - More B than A (B is in excess, A is limiting)
- The limiting reagent (reactant) determines how far the reaction will proceed.
- Example to follow:



Limiting Reagent Example



- How many grams of NH_3 can be produced from the reaction of 28 g of N_2 and 25 g of H_2 ?
- Relate the moles of each!
 - $28\text{g N}_2 / (28 \text{ g/mol N}_2) = 1 \text{ mol N}_2$
 - Convert to grams of NH_3
 - $25\text{g H}_2 / (2 \text{ g/mol H}_2) = 12.5 \text{ mol H}_2$
 - Convert to grams of NH_3
- Produces more = excess reagent
- Produces less = limiting (actual amount capable)

